Michigan Criteria for On-Site Wastewater Treatment

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Edit 12/21/2011
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Introduction

This document replaces the "Michigan Criteria for Subsurface Sewage Disposal" revision dated April 1994, published by the Michigan Department of Public Health. The criteria were developed by a constituent workgroup convened by the Michigan Department of Environmental Quality (DEQ) and included representation from local county and district health departments, academia, private sector consultants and industry representatives.

The criteria represent an overall change in philosophy intended to guide the department and authorized local health departments. The criteria are to be utilized in the approval of on-site wastewater systems utilizing subsurface soil based dispersal which treat sanitary sewage and/or domestic equivalent wastewater with flows up to 20,000 gallons per day (gpd). The criteria provide flexibility to allow consideration of both present and future technology that may become available. The revised criteria place strong emphasis on the need for professional competence. Rather than being totally prescriptive, the revised criteria establish a process for determining treatment objectives based upon risk. Provisions for long term operation and maintenance (O & M) are also stressed.

Supplementing the criteria will be separate guidance documents to provide direction on topics of a non-proprietary nature which will be developed as needed over time with input of other on-site wastewater professionals from local health, academia and the private sector. Nationally there already exists a wealth of such information. As appropriate, where accepted guidance already exists, it will be cited for reference.

Chapter 1 – Administration, Purpose, and Applicability

1.1 Administration

This document has been established as a guideline pursuant to the requirements of the Administrative Procedures Act, 1969 PA 306, as amended. Guideline as defined therein means "An agency statement or declaration of policy which the agency intends to follow, which does not have the force or effect of law, and which binds the agency but does not bind any other person." It is intended that "agency" as used above also includes local health departments, when acting as an agent of the DEQ. The revised criteria communicate a standard by which decisions for approval of systems utilizing subsurface dispersal are made resulting in authorization to discharge pursuant to Part 31: Water Resources, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and the Part 22 rules, specifically §323.2210, §323.2211 & §323.2216.

1.2 Purpose

The purpose of the criteria is to assure that the construction, operation and maintenance of on-site wastewater treatment systems utilizing subsurface dispersal in quantities of less than 20,000 gpd:

1. Are approved and constructed in a uniform manner consistent with the criteria.

2. Are routinely operated and maintained to assure proper treatment and function.

3. Will not contaminate any existing or future drinking water supply

4. Will not give rise to a public health or safety hazard or present the potential for creating a hazard.

5. Will not contaminate groundwater or surface water.

6. Will not give rise to a nuisance due to odor or unsightly appearance.

7. Will not otherwise violate laws or regulations governing water pollution or sewage disposal.

1.3 Applicability

The revised criteria have been developed for use by the department and local health departments responsible for the consistent review and approval of on-site wastewater treatment systems with subsurface dispersal. The criteria are to provide minimum uniform review standards for approval of such systems in Michigan.

It should be noted that these criteria pertain to the treatment and dispersal of sanitary sewage (e.g. toilet wastes, sink and laundry waste, and bath water) or domestic equivalent wastewater. The treatment and dispersal of wastes from industrial and commercial processes (laundromats, car washes, floor drains, etc.) requires specific Part 22 authorization by the DEQ. The criteria also do not apply to private single and two family residential sewage systems constructed pursuant to local health department (LHD) sanitary codes.

These criteria are applicable to approvals involving the following

1. Proposals for construction of treatment systems at new structures;
2. Proposals for new or increased uses at existing structures; or
3. Proposals to construct replacement systems where the existing system has failed.

Chapter 2 – General Provisions

2.1 General

Prior to the construction of a system under the criteria, construction approval and required permits must be obtained from the agency having jurisdiction. Construction or modification of the facility served by a soil-based dispersal system shall not begin until a construction permit and plan approval for the sewage system has been obtained.

It is strongly recommended that a utility locating service (e.g. Miss Dig) be contacted prior to any site excavation to determine the location of underground utilities.

2.2 Construction Plans, Supervision, Inspections and Approvals

2.2.1 – System Designer Qualifications and Other Competent Professionals

The design and submittal of plans for systems designed under the criteria should only be made by those professionals that possess competence in all aspects of soil-based wastewater treatment and dispersal systems gained through a combination of education and experience. For all phases of the project that the system designer lacks competence, the services of other competent professionals shall be retained.

2.2.2 – Construction Plans

The agency shall require the submittal of detailed construction plans for all systems constructed under the criteria. The detailed construction plans are to be submitted to the agency after the site suitability, wastewater strength and design flow have been determined pursuant to Chapter 4, Chapter 5 and Chapter 6, respectively. The detailed plans shall be prepared by either a licensed professional engineer or a registered sanitarian in private practice, who are licensed or registered by the State of Michigan.

The agency has the discretion to waive the submittal of detailed construction plans for small conventional systems or alternative systems utilizing pressure distribution expected to generate flows less than 1,000 gpd. For these situations, review and approval by the agency shall be completed under the supervision of a competent licensed professional engineer or registered sanitarian.

2.2.3 – Construction Supervision

In cases where the agency has required the submission of detailed construction plans, the system designer is responsible to provide for the supervision of construction adequate to assure compliance with approved permit conditions, plans and specifications. The agency shall require written certification by the project's system designer that construction was completed in accordance with approved plans and specifications.

The installer shall not deviate from the approved design unless authorized by the system designer and the agency. Requests to deviate from approved plans shall be in writing.

2.2.4 – Construction Inspection and Final Approval

The agency is to make such inspections as deemed necessary during construction to assure compliance with approved permit conditions, plans and specifications or utilize an alternate process to accomplish this. Treatment system components shall not be backfilled until the agency has given its approval, or unless waived by the agency due to mitigating circumstances. Waivers shall be documented in writing by the agency.

The final approval of the system construction by the agency shall be withheld pending receipt of written certification from the system designer and documentation of a final inspection by the agency.

2.3 Public Sanitary Sewer and On-site/Decentralized System

Connection to a public sanitary sewer system is required when available as defined by Section 12751 through 12758 of the Public Health Code, 1978 PA 368, as amended, being §333.12751 through §333.12758 of the Michigan Compiled Laws and when the local governmental entity having jurisdiction requires connection. Local governmental entities may also have planning that designates areas to be served by on-site/decentralized systems as the preferred wastewater infrastructure. Prior to evaluation of a site where the availability and requirement for connection to a public sewer system is in question, a statement from the appropriate governmental entity regarding the availability of the sewer should be submitted to the agency.

2.4 Other Regulations

Beyond the approval gained pursuant to the revised criteria, it remains the responsibility of the applicant to comply with any and all other codes, rules ordinances or other criteria. Issuance of an approval under the criteria does not authorize violation of other federal, state or local laws and regulations.

Chapter 3 – Variances and Appeals

3.1 Basis for Variance

It is the intent of the criteria to provide <u>minimum</u> standards to be used in site evaluation and the design and construction of soil-based dispersal methods systems. However, there may be special circumstances which justify a variance from particular provisions. Such variances may be granted by the department or local health department having jurisdiction only when <u>all</u> the following are met:

1. Where the provisions contained within the criteria cannot be met or where strict compliance is not required to meet the purpose of the criteria.
2. Where other more acceptable alternatives are not available.
3. Where the requested variance will not create the potential for a health hazard, nuisance condition, or the pollution of groundwater or surface water, or otherwise violate the purpose of these criteria as stated in Section 1.2.

3.2 Variance Procedures

The following procedure shall be followed in granting requests for variances:

1. The applicant shall file a written request with the DEQ or delegated local health department. The request shall cite the specific provisions of the criteria which it is requested for. The variance request shall be supported by information describing the physical characteristics of the site, reasons for requesting the variance and justification for granting the variance. Sufficient information to verify the protection of the public health, surface and groundwater shall be supplied.

2. The DEQ and the appropriate local health department shall consult prior to granting a variance. A record of that consultation shall be made and maintained in both agencies' files.

3. Variances may only be granted by the DEQ for facilities requiring DEQ construction permits or DEQ approval only. For all other facilities, joint authorization of both the director of Environmental Health of the city,

county, or district health department and the DEQ is required.

4. Variances thus granted apply only to the specific project under consideration and do not serve as precedents in other cases.

3.3 Appeals

Local health departments do not have the authority to approve proposals which do not meet these criteria, except through the variance provisions. Appeals of approvals or denials issued pursuant to the revised criteria may be made to the DEQ by filing of a request for contested case hearing on the matter pursuant to the Administrative Procedures Act.

Issuance of a denial for proposals which do not meet the criteria for subsurface dispersal does not preclude the ability of the applicant to pursue other methods of wastewater treatment and dispersal where authorization can be secured from the department.

Chapter 4 – Establishing Site Suitability for Soil Dispersal

4.1 General

Multiple factors establish the suitability for soil dispersal at a specific site. This section addresses these various site and soil factors which must be addressed during the initial site evaluation. Information gathered and provided for review during the site evaluation process must confirm the availability of an acceptable soil dispersal area and reserve area. A contingency plan that does not include a reserve area may only be considered through a variance process described in Chapter 3. This information also provides the basis for detailed design of the treatment and dispersal system.

The agency shall not approve the site when site conditions inclusive of soils, high groundwater elevation, terrain, and/or area available for soil dispersal or other conditions will prevent the satisfactory operation of a system in a manner which fulfills the purpose of the criteria. Necessary field tests and evaluation of other factors by the agency shall be completed under the supervision of a licensed professional engineer or registered sanitarian to confirm the suitability of a site. The site evaluation process should only be completed by those individuals in private practice who have competency in the design of on-site wastewater treatment systems or who have retained the services of other competent professionals. It is the responsibility of the system designer to coordinate the field aspects of the site evaluation with the agency.

4.2 Pre-Application Meetings

A pre-application meeting is an opportunity for the applicant or designated representative to meet with the system designer and the agency to discuss the proposed project. Such a meeting is most beneficial when it occurs early in the planning phase when a project proposal is defined enough to discuss it conceptually, but still flexible enough to incorporate recommendations from the meeting. The pre-application meeting can also be beneficial regardless of the projected flow for the facility. For facilities projected to produce wastewater flows in excess of 6,000 gpd a pre-application meeting is strongly encouraged prior to completing the field evaluation. Where projected flows exceed 10,000 gpd a pre-application meeting shall be scheduled and conducted prior to completing the field site evaluation.

The applicant or designated representative should provide and be prepared to discuss, the following information at the meeting:

1. Type of existing or proposed facility; anticipated flows and type or character of the wastewater.
2. Location map - such as a county road map, showing the general location of the site.
3. General Site map - showing all existing and proposed features of the site.
4. USDA soil survey map – identifying the predominant soil series of the site. (Map must include Township, Range, and Section)
5. Conceptual plans, if available.

4.3 Preliminary Site Evaluation

A preliminary site evaluation is necessary and is to be completed by the system designer prior to completing the field evaluation. The preliminary site evaluation shall consist of gathering the information contained in Section 4.2 and the following additional information:

1. Existing and proposed buildings or improvements on the lot or site.
2. Documentation confirming the location of buried on-site utilities, if available. It is recommended that the system designer contact a utility locating service (e.g. Miss Dig).
3. Easements on the site.
4. Current and past land use (if it can be determined).
5. The ordinary high water level of surface waters, if established. For on-site treatment systems of 6,000 gpd or more, the location of surface water which will be within 500 feet of the soil dispersal system(s) shall be documented.
6. Established 100 year floodplain elevation and boundary on the site if applicable.
7. Property or boundary lines.
8. All required horizontal isolation distances from the proposed subsurface dispersal system as indicated in Table 4.1.

4.4 Field Site Evaluation

In all instances the system designer must coordinate a joint field site evaluation with the agency. As part of the evaluation, the system designer shall establish the following information about the site:

1. Site boundaries.
2. Proposed and existing site improvements, required setbacks, and easements must be identified.
3. Underground utilities must be located by calling Miss Dig and other appropriate utilities before soil excavations and observations are undertaken.
4. Topographic information and other factors that may influence dispersal system design.
5. Any evidence of cut or filled areas or disturbed or compacted soil.
6. The flooding or run-on potential to the proposed dispersal area(s).
7. A sufficient number of soil profile evaluations to confirm the existence of suitable soils for both the initial and reserve soil dispersal areas with at least one soil observation performed in the portion of the soil dispersal area anticipated to have the most limiting conditions. However, a minimum of three soil observations are required for systems with design flows greater than 1,000 gpd In areas of complex soils, additional evaluations may be necessary. The competent soil evaluator shall evaluate enough test pits to characterize soil type (per USDA classification) and conditions across both the initial and reserve soil dispersal areas.
8. Soil evaluations should be completed by observation of shallow soil pits of adequate size, depth, and construction to safely enter and exit the pit and complete a soil profile description. A hand auger may be used for systems with flows less than 1,000 gpd and which will incorporate a below-grade dispersal component that is not dependent on soil structure. **Use of power augers is not acceptable.** Other soil boring methods may be used with prior approval of the agency. If test pits are to be open for an extended period they should be protected from unauthorized entry.

   Note: Required safety precautions must be taken before entering soil test pits.
9. Each test pit must be prepared so that the soil profile can be viewed in an original undisturbed position to a depth of at least six (6) feet; to a restrictive soil horizon or bedrock; or to the high groundwater elevation, whichever is shallower. Soil excavations shall always be of sufficient depth to provide adequate information for the design of the system. Other soil characteristics need to be described that will affect the design of the system; such as hardpan, fragipan or other restrictive soil horizons.
10. Each soil profile observation must be evaluated under adequate light conditions with the soil in a moist and unfrozen state. Optimally, soil

evaluations should be completed during those time periods where soils are sufficiently dry and completed in a manner which avoids damage to the proposed absorption area.

11. Soil evaluations must be completed and accurately reported by a competent soil evaluator experienced with the USDA Soil Classification system. All of the following shall be reported:

    a. Soil horizon depths (as measured from the ground surface);
    b. Soil texture (per USDA soil classification system);
    c. Soil structure;
    d. Soil mottling;
    e. Depth to high groundwater elevation or bedrock
    f. Groundwater levels observed at the time of the soil evaluation.
    g. The reporting of soil color, using a Munsell soil color chart to describe the soil matrix, may be necessary based on proposed flows or other factors.

12. The location of the soil boring(s) or excavation(s) which establish the approved area for the proposed soil dispersal system(s) to be installed shall be documented in a verifiable manner. Each soil observation shall be located with measurements from two permanent reference points, or equivalent.
13. The boundaries of the approved area for the proposed soil dispersal system(s) shall be visually marked and a reliable benchmark established on the site that can be used for horizontal and vertical control. All proposed initial and reserve soil dispersal areas shall be protected from disturbance, compaction, or other damage by staking, fencing, posting, or other effective method as soon as practical.

4.5 Site Evaluation Reporting/Final Site Plan and Evaluation

Information gathered by the system designer during the preliminary and field site evaluations shall be documented on a site report to the agency. The report shall also address any of the following: (as appropriate)

1. Construction related issues such as rocks, tree stumps, high clay content soils, slope and topography.
2. An initial recommendation of the type and number of soil dispersal areas, size of those areas, system layout, geometry and distribution method to mitigate concerns such as groundwater mounding and impacts to groundwater or surface water.
3. Any special design considerations (high permeable soils (e.g. coarse sand), floodplain, disturbed soil, low permeable soils (e.g. clay loams), etc.).
4. Impacts from upslope run-on areas.
5. Uniformity of the soil conditions.

6. Future surrounding land use changes (if known).

4.6 Dispersal Area Suitability

4.6.1 Soils – Areas to be utilized for soil dispersal shall consist of undisturbed natural soils. Historical agricultural activities are not generally considered as disturbance.

4.6.2 Soil texture and structure – Must be a suitable soil texture and structure as indicated in Table 4.2 for which a soil hydraulic loading rate (see Section 4.7) has been shown.

4.6.3 Depth to high groundwater elevation – An 18-inch minimum isolation from the undisturbed natural ground surface to high groundwater elevation over the entire area to be used for soil dispersal. The depth to high groundwater elevation shall be confirmed by a soil profile with six (6) inches or more of soil without redoximorphic features (a.k.a. mottling) below the “A” horizon (topsoil). Groundwater elevation monitoring in accordance with Section 4.10 may also be considered. Increased vertical isolation to high groundwater may be necessary in consideration of groundwater mounding.

4.6.4 Groundwater Mounding – For all sites the system designer shall consider the potential for groundwater mounding that may occur as the result of the proposed discharge. Approval shall not be granted where groundwater mounding concerns cannot be mitigated through the soil-based dispersal system design which account for these site specific characteristics.

4.6.5 Reserve Area – For proposed new uses, sufficient suitable area shall be available and reserved to provide for a minimum of one replacement system without utilization or disruption of the initial installation.

4.6.6 Slope - Natural ground slope should be less than 25 percent in the system area to promote safety of workers during construction.

4.6.7 Location and Horizontal Isolation – Table 4.1 identifies the minimum horizontal isolation distances which shall be observed to allow proper installation, maintenance and be protective of the environmental and public health. These minimums may only be increased based upon site specific conditions and the nature of the proposed discharge. Reduced isolation may only be considered through the variance process described in Chapter 3.

Table 4.1
Minimum Horizontal Isolation Distances

From Soil Dispersal and Tank* To:	Minimum Horizontal Isolation Distance (feet)
Type I Public Well	200
Type II-a Public Well	200
Type II-b Public Well	75
Type III Public Well	75
Private Individual Well	50
Surface Waters	100
Basement Foundation Walls	10
Top of Drop-Off	20
Property Lines	10
Footing drains installed in water table without direct connection to surface water	25
Footing drains installed in water table with direct connection to surface water	50
Drains designed to lower the water table	100
Pressurized Water Lines	10

* as measured from perimeter of dispersal system or tank.

4.7 Soil Hydraulic Loading Rates and Linear Loading Rates

The system design must allow for soil hydraulic loading rates and linear loading rates as shown in Table 4.2. The soil hydraulic loading and linear loading rates shall be determined by the U.S.D.A. soil texture and structure of the infiltrative surface or the most limiting soil texture as described in Table 4.2.

The soil hydraulic and linear loading rates in Table 4.2 are not the only factors that must be considered in determining the acceptability of a design and layout of a soil-based dispersal system. Additional factors that must be considered in evaluating groundwater mounding potential include ground slope, available soil infiltrative depth above restrictive layers and established high groundwater elevation. In general, the potential for groundwater mounding will increase with the volume discharged.

Table 4.2
Soil Loading Rates for Infiltrative Surfaces

SOIL TEXTURE	SOIL STRUCTURE		HYDRAULIC LOADING RATE (gpd/ft2)		LINEAR LOADING RATE (gpd/ft)
	SHAPE	GRADE	BOD>30 mg/L and < 140 mg/l*	BOD<30 mg/L	
Coarse sand, Sand, Loamy coarse sand, Loamy sand	Single grain	Structureless	0.8	1.6	6
Fine sand, Very fine sand, Loamy fine sand, Loamy very fine sand	Single grain	Structureless	0.4	1.0	5
Coarse sandy loam, Sandy loam	Massive	Structureless	0.2	0.6	4
	Platy	Weak	0.2	0.5	
		Moderate, Strong			
	Prismatic , Blocky, Granular	Weak	0.4	0.7	
		Moderate, Strong	06	1.0	
Fine sandy loam, Very fine sandy loam	Massive	Structureless	02	0.5	3
	Platy	Weak, Moderate, Strong			
	Prismatic , Blocky, Granular	Weak	0.2	0.6	
		Moderate, Strong	0.4	0.8	
Loam	Massive	Structureless	0.2	0.5	3
	Platy	Weak, Moderate, Strong			
	Prismatic , Blocky, Granular	Weak	0.4	0.6	
		Moderate, Strong	0.6	0.8	
Silt Loam	Massive	Structureless		0.2	3
	Platy	Weak, Moderate, Strong			
	Prismatic , Blocky, Granular	Weak	0.4	0.6	
		Moderate, Strong	0.6	0.8	
Sandy clay loam, Clay loam, Silty clay loam	Massive	Structureless			2.5
	Platy	Weak, Moderate, Strong			
	Prismatic , Blocky, Granular	Weak	0.2	0.3	
		Moderate, Strong	0.4	0.6	
Sandy clay, Clay, Silty clay	Massive	Structureless			2.5
	Platy	Weak, Moderate, Strong			
	Prismatic , Blocky, Granular	Weak			
		Moderate, Strong	0.2	0.3	

Source: Adapted from Tyler, 2000 – USEPA Onsite Wastewater Treatment Systems Manual
* For BOD_5 >140 mg/l, see Chapter 5

Table 4.3
Dispersal System Design Criteria

BOD_5	Dispersal Type	Distribution*	Dispersal System Sizing**
$BOD_5 > 30$ mg/l< 140 mg/l	Below Grade	Gravity distribution only acceptable for systems < 1,000 gpd. All others must use pressure distribution or equal.	Must have hydraulic loading rate and linear loading rate not to exceed values as listed in Table 4.2. Sizing based upon soils at infiltrative surface unless other treatment/dispersal restrictions imposed.
	At Grade	Pressure distribution or equal for all systems > 1,000 gpd and soils with hydraulic loading rate <0.3.	Must have hydraulic loading rate and linear loading rate not to exceed values as listed in Table 4.2. Sizing based upon most limiting soil texture and structure in upper 18-inches of natural soil.
	Above Grade	Pressure distribution or equal for all systems > 1,000 gpd and soils with hydraulic loading rate <0.3.	Sizing based upon hydraulic loading rate for BOD < 30 mg/l with a minimum of one (1) foot of fill and pressure distribution. Must have hydraulic loading rate and linear loading rate not to exceed values as listed in Table 4.2. Sizing based upon most limiting soil texture and structure in upper 18-inches of natural soil.
$BOD_5 < 30$ mg/l	Below Grade	Gravity distribution only acceptable for systems < 1,000 gpd. All others must use pressure distribution or equal.	Must have hydraulic loading rate and linear loading rate not to exceed values as listed in Table 4.2. Sizing based upon soils at infiltrative surface unless other treatment/dispersal restrictions imposed.
	At Grade	Pressure distribution or equal for all systems > 1,000 gpd and soils with hydraulic loading rate <0.3.	Must have hydraulic loading rate and linear loading rate not to exceed values as listed in Table 4.2. Sizing based upon most limiting soil texture and structure in upper 18-inches of natural soil.
	Above Grade	Pressure distribution or equal for all systems > 1,000 gpd and soils with hydraulic loading rate <0.3.	Must have hydraulic loading rate and linear loading rate not to exceed values as listed in Table 4.2. Sizing based upon most limiting soil texture and structure in upper 18-inches of natural soil.

* All Deep Cut Systems (see Section 4.11) must utilize pressure distribution or equivalent.
** See Chapter 5 for High Strength Wastewater considerations.

4.8 Isolation to High Groundwater Elevation

To provide for adequate soil treatment capability, a minimum of three (3) feet of unsaturated soil shall exist between the bottom of the infiltrative surface and the high groundwater elevation or restrictive layer for residential strength wastewater (see Chapter 5). Greater vertical separation may be required in accordance with the regulations of the city, county, or district health department having jurisdiction under the authority granted by the Public Health Code, 1978 PA 368, as amended, being §325.1101 et seq. of the Michigan Compiled Laws. Greater vertical separation may also be required where groundwater mounding underneath the soil absorption system or other factors would limit the treatment to protect groundwater or surface waters. For systems utilizing an approved alternative treatment technology, pursuant to Chapter 9, a one (1) foot reduction in vertical isolation may be allowed by the agency.

4.9 Use of Drainage Systems to Control High Groundwater Elevation

The elevation of soil mottling and/or other redoximorphic features in a soil profile is the primary factor in determining the high groundwater elevation and the vertical isolation needed for the subsurface soil dispersal systems. The agency may approve the use of a proposal that includes surface or subsurface gravity drainage systems to control high groundwater elevation conditions. This may entail the construction of new drainage systems or utilization of existing drainage systems on or nearby the site which is believed to have lowered the high groundwater elevation.

4.9.1 Drainage System Design and Construction

The design of the drainage system, either existing or proposed, shall be reviewed and approved by the agency. A responsible management entity (e.g. county drain commissioner) shall be identified to assure perpetual maintenance of the drainage system.

Before approval of the drainage system, the proprietor or his designated representative shall monitor high groundwater elevations as outlined in Section 4.10 below to confirm the high groundwater elevation has been lowered by means of the surface or subsurface gravity drainage systems.

4.10 Demonstration of High Groundwater Elevation Control

In instances where surface and subsurface drainage systems or other site factors are believed to have lowered the high groundwater elevation below that is indicated by soil mottling and/or other redoximorphic features, monitoring of the groundwater elevation can be used to demonstrate this belief.

Prior to site approval, the proprietor or their designated representative shall monitor high groundwater elevations during the normally wettest time period of the year and at least from March 1 to June 1. The system designer or their designated representative shall provide monitoring results to the agency.

In addition, the proprietor or their designated representative shall substantiate that high groundwater elevation has been lowered a minimum of 18-inches from the natural, unaltered grade.

4.10.1 Groundwater Elevation Monitoring

The specific steps to be utilized for the monitoring of groundwater elevation are as follows:

1. Proposed monitoring well locations and design shall be reviewed and approved by the agency.

2. After approval, the monitoring wells shall be installed at the approved locations and depths.

3. The system designer or their designated representative shall monitor high groundwater elevations beginning the first day of the monitoring period and at least once every seven (7) days thereafter until the monitoring period is complete.

4. The system designer or their designated representative shall provide representative precipitation data to the agency for the time period of September 1 to May 31. The summary of the compiled data shall be submitted to the review agency.

The results of high groundwater elevation monitoring are inconclusive if the recorded precipitation totals are less than 90% of normal averages during the time period of September 1 to May 31.

4.11 Excessively Permeable and Shallow Natural Soils

Excessively permeable soils are those having more than 60 percent of rock fragments, gravel, pebbles or cobbles in a soil profile and have a preponderance of macro pores that allow wastewater constituents such as pathogens and nutrients to pass through the soil very rapidly. This is also the case where there are very shallow natural soils over fractured bedrock. These situations do not allow for adequate residence time required for the physical, chemical and biological treatment within the soil body and present distinct concerns related to the contamination of groundwater supplies or surface waters. These situations may only be considered in conjunction with a careful and comprehensive evaluation of site specific environmental and public health concerns.

Consideration of a pre-treatment system may be warranted to address these concerns.

4.12 Deep Cut Excavations

4.12.1 Criteria for Acceptance of Deep Cut Excavations

If suitable soils as specified in Table 4.2 are not present within the upper six (6) feet of the soil profile and alternative methods of sewage treatment and dispersal have been considered under Chapter 9 or Chapter 14, then the agency may approve the use of deep cut excavations to expose acceptable underlying soils that exist within 20 feet of the natural grade provided all of the following is demonstrated:

1. Acceptable underlying soils shall consist of a minimum of four (4) feet of soils which have a USDA texture no finer than sandy loam and which are not permanently or seasonally saturated as confirmed by soil profile evaluations and supportive hydrogeological information. Groundwater elevation monitoring as described I Section 4.10.1 should be utilized in situations where this information is to conclusive to the agency. Underlying soils shall be of areal extent not expected to restrict movement of treated effluent.

2. The level of treatment required prior to dispersal shall be established pursuant to the requirements of Chapter 5 – Wastewater Characterization.

3. Discharge to the soil-based dispersal system shall be accomplished by pressure distribution.

4. For deep cut excavations, the agency may require alternative methods of sewage treatment (see Chapter 9).

5. The system design must allow for complete deep cut excavations over 100% of the required initial and reserve dispersal system area for the upper five (5) feet; however, excavations may be reduced to a minimum of 50% of the required dispersal system area between five (5) and 20 feet deep.

6. Deep cut excavations shall not cut through soils that are seasonally or permanently saturated. Exceptions may be considered where a demonstration of the drainage of groundwater from overlying soils would not be expected to adversely impact the function of the soil-based dispersal system.

7. Hydrogeological information is provided that confirms that the underlying soils being exposed have no direct hydraulic connection to a useable aquifer intended for drinking or household purposes.

4.12.2 Acceptable Fill Material and Certification

Once approved by the agency, deep cut excavations shall be completed and filled with medium to coarse sands without excessive fines (see Appendix ? for testing procedures). The system designer or their designated representative shall provide certification of fill materials and placement to the agency.

Chapter 5 – Wastewater Characterization

5.1 Waste Strength Assessment

It is the responsibility of the system designer to assess waste strength for the facility. This can be accomplished by means of an estimation or actual assessment of waste strength. Primary sources of information include the facility itself when dealing with a system repair or increased use. Another source of information is comparative data obtained from similar facilities that is determined to be acceptable to the agency.

Hydraulic performance, treatment performance and longevity of a subsurface wastewater treatment system can be drastically affected by the wastewater composition. The strength of raw wastewater should be characterized for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Fats, Oils and Grease (FOG) and total nitrogen(TKN) (e.g. waste strength = BOD + TSS + FOG + TKN). Typical values for influent wastewater produced by residential dwellings is assumed to fall within the ranges shown in Chart 5.1 and need not be assessed further. Likewise, sanitary wastewater discharges from facilities without a process water component (e.g. retail, office space, manufacturing, etc.) would also be presumed to have strength falling within these values.

Table 5.1
Residential Wastewater Strength

Residential Wastewater	Influent Strength	Typical Filtered STE
BOD5	155 – 286 mg/l	140 mg/l
TSS	155 – 330 mg/l	55 mg/l
FOG	70 – 105 mg/l	20 mg/l
TKN	26-75 mg/l	90 mg/l
NH_4	4-13 mg/l	50 mg/l
TP	6-12 mg/l	16 mg/l

By comparison, filtered domestic septic tank effluent from residential dwellings has typical concentrations of BOD, TSS, FOG and TKN that are expected to be on the average no higher than 140mg/l, 55 mg/l, 20mg/l and 90mg/l (Ammonia 50mg/l), respectively.

System design must account for concentrations of constituents that are above typical residential strength. The design must provide additional treatment which would be expected to produce effluent quality meeting required treatment objectives prior to the soil-based dispersal component.

5.2 Facilities Generating High Strength Waste

Certain facilities can be expected to produce wastewater with high organic strength and elevated FOG characteristics. In particular, these high strength situations are associated with facilities where food preparation makes up a major part of their daily operation. Examples include fast food and full service restaurants, dining halls, bakeries, and grocery stores with deli and meat counters. These uses are presumed to meet the designation of high strength unless acceptable representative data is otherwise provided. The design for these uses will generally make use of a pretreatment system in order to produce minimum effluent quality meeting the residential strength treatment objective prior to discharge to the soil-based dispersal system. For the above facilities the agency will presume that septic tank effluent will have the following strength:

1. BOD5 – 1200 mg/L
2. TSS – 220 mg/L
3. FOG – 200 mg/L

5.3 Soil Loading Based on Organic Strength

The traditional method of sizing a soil-based dispersal system area is based on appropriate hydraulic loading rates for site-specific soil characteristics, as shown in Table 4.2. These rates are based on effluent quality not exceeding residential strength as indicated in Table 5.1. Wastewater with high organic strength requires special design consideration from the soil dispersal standpoint due the potential for soil clogging. To prevent soil clogging, research shows it is important to adjust the hydraulic loading rate and loading pattern. It is not always necessary to pre-treat high strength wastewater, since the organic loading rate can be considered in the design. In instances where pre-treatment is not utilized, the organic loading must be considered in sizing the soil-based dispersal system.

The organic loading rate varies directly with BOD5. The following equation is provided as an adjustment factor to establish the soil hydraulic loading rate based proportionally on BOD5.

Adjustment Factor for High Strength Waste

$$\frac{\text{140 mg/l BOD5*}}{\text{Expected High Strength Waste (mg/l BOD5)}} \quad \text{X} \quad \text{Soil Hydraulic Loading Rate}$$

*Typical Residential Strength Waste

Example:

Assume that the soil-based dispersal system area must be designed for a restaurant with septic tank effluent having the following characteristics:

Design Flow = 700 gallons per day (gpd)
BOD5 = 1200 mg/L
Soil Hydraulic Loading Rate = 0.6 gpd/sq ft

The Organic Soil Loading Rate =
(140 mg/l BOD5 ÷ 1200 mg/l) x 0.6 gpd/sq ft = 0.07 gpd/sq ft

Required Soil Dispersal Area = 700 gpd ÷ 0.07 gpd/sq ft = 10,000 sq ft
Note: An area of 20,000 square feet is needed inclusive of the initial and reserve areas.

5.4 Nutrient Considerations

From a nutrient standpoint, nitrogen is the primary concern. Certain facilities can be expected to produce wastewater with elevated nitrogen concentration causing them to be characterized as high strength. Examples include schools, supermarkets and truck stops which routinely make use of ammonia based cleaning agents; facilities where a high percentage of the wastewater is generated by toilet use; and facilities using low-flush or waterless fixtures. These types of uses are presumed to meet the designation of high nutrient strength wastewater unless other acceptable representative data is provided. The design for these uses will generally incorporate pretreatment in order to produce effluent quality meeting treatment objectives prior to discharge to the soil-based dispersal system.

5.5 Domestic Equivalent Activities

Certain commercial and industrial uses result in wastewater that falls outside the definition of sanitary sewage. However, the wastewater may have characteristics that can be shown to fall within values for sanitary wastewater for other facilities considered under the criteria. On a case-by-case basis these activities may be considered for approval under the criteria and discharged to the soil-based dispersal system. Information must be supplied to the agency either derived from the facility itself or through comparative data that acceptably documents that the wastewater is of domestic equivalent and suitable for treatment and groundwater discharge. Domestic equivalent flows may only be considered if the waste characteristics are suitable for discharge into the soil and comply with other applicable local, state and federal regulations.

Chapter 6 – Establishing Wastewater Flow

6.1 General

The determination of wastewater design flow is one of the most important items in the planning of a new or expanded treatment system. Records of measurements of actual flow from existing installations or from similar establishments in similar locations should be used for system sizing when they can be obtained. In the absence of actual data, design flows for facilities noted in the “Onsite Treatment Systems Manual, 2002”, United States Environmental Protection Agency, EPA/625/R-00/008 can be used as a guide, or other references that are acceptable may be used to determine anticipated flow volumes. These methods provide guidance on estimating the volume of sanitary sewage flow only. For systems anticipated to receive both sanitary sewage and domestic equivalent wastewater, the domestic equivalent volume must be determined separately based on actual flows or existing comparable use data.

6.2 Wastewater Flows For Community Systems

Typical community on-site wastewater systems are those that collect and treat sanitary sewage generated by multiple residential homes. Available data identify consistent average daily flows ranging from 65 – 75 gpd/bedroom. Table 6.1 suggests design flows assuming a consistent average flow of 70 gpd/bedroom and a variable peaking factor which decreases as the total number of homes served increases.

Table 6.1
Community System Suggested Basis of Design

4 Bedroom Homes

Number of Homes	Average (gal/day/home)	%Peaking factor	Design flows (gal/day/home)
2 - 10	280	25%	350
11- 20	280	20%	336
21 -30	280	15%	322
30+	280	10%	308

3 Bedroom Homes

Number of Homes	Average (gal/day/Home)	%Peaking factor	Design flows (gal/day/home)
2 - 10	210	25%	263
11- 20	210	20%	252
21 -30	210	15%	242
30+	210	10%	231

2 Bedroom Homes

Number of Homes	Average (gal/day/home)	%Peaking factor	Design flows (gal/day/home)
2 - 10	140	25%	175
11- 20	140	20%	168
21 -30	140	15%	161
30+	140	10%	154

The agency may also consider site specific data presented by the system designer from initial phases of the same development or data from other comparable existing developments. Community systems serving non-residential facilities (e.g. strip mall, commercial, etc.) shall be considered on a case-by-case basis.

Chapter 7 – Groundwater and Surface Water Protection

7.1 General

Under all soil conditions, consideration must be given to the protection of groundwater and surface waters. This is especially critical in very permeable soils and in areas where rock formations are near the ground surface. Available data obtained from test wells or nearby water supply wells should be included as part of the plan submittal. Test wells and/or deep borings and backhoe cuts may be required to determine the available site conditions providing for the protection of groundwater and surface waters.

The potential risk for contamination of groundwater aquifers and nearby surface waters increases as the amount of wastewater discharged increases. During the planning and design phase of a potential future discharge, these risks must be evaluated on an individual, case-by-case basis to determine the necessary pretreatment option. Based upon an established risk, pretreatment may be incorporated into the design of the system as necessary to reduce the nitrogen and/or phosphorous in the final effluent to a level that is expected to be protective of both the groundwater and surface waters. This potential risk can be determined by evaluating the site for both groundwater and surface water vulnerability.

7.1 Groundwater Vulnerability

In all instances, any system being designed, constructed, operated and maintained under the criteria it shall be substantiated that groundwater quality of usable aquifers is protected for existing or future use. Categorizing aquifer vulnerability can range from a very basic assessment of available water supply well records, to in-depth and detailed hydrogeological studies. In general, the need for a more rigorous evaluation increases as the volume of discharge increases.

Assessment of groundwater vulnerability is completed by review of site specific information, including but not limited to the review and consideration of the following:

1. Surface soil texture and permeability;
2. Presence or absence of confining layers of sufficient areal extent between the soil-based dispersal system and uppermost usable aquifers;
3. Horizontal isolation afforded to existing and future water supply wells;
4. Direction of groundwater flow/venting;
5. Depth to high groundwater elevation.

Groundwater vulnerability may be established by consideration of the surface soil textures first and the presence/absence of confining layers. Groundwater vulnerability should be established based upon a review of the land area within ¼ mile radius of the proposed soil-based dispersal system unless it has been elected to conduct a detailed hygrogeological assessment.

Surface soils can be classified into three permeability categories based upon recognized USDA soil texture descriptions as follows:

Rapidly permeable – Sand (S), Loamy Sand (LS)
Moderately permeable – Sandy Loam (SL), Sandy Clay Loam (SCL), Loam (L), Silt Loam (SiL), Silt (Si)
Slowly Permeable – Clay Loam (CL), Silty Clay Loam (SICL), Silty Clay (SC), Clay (C)

The presence or absence of confining layers can sometimes be established based upon a review of existing water supply well records where available. A more accurate determination can be made through completion of a sufficient number of water supply wells or test wells. Aquifer vulnerability can then be ranked as low, moderate or high based upon the following conditions:

Table 7.1

Vulnerability Class	**Conditions**
Low	o Rapidly, moderately and slowly permeable soils with confining layers of areal extent or no on-site water supply concerns (e.g. community water available).
Moderate	o Moderately and slowly permeable soils with discontinuous confining layers or without confining layers.
High	o Rapidly permeable soils with discontinuous confining layers or without confining layers.

Groundwater flow direction can also become an important consideration in establishing groundwater vulnerability. Examples include instances where nearby existing or future wells lack confining layers and determining impacts on down-gradient water supply wells are important. Likewise, a determination of groundwater flow direction shall be documented where venting to surface water is proposed as a protection mechanism.

7.2 Surface Water Vulnerability

The greatest risk to surface water quality relates to the potential impacts from phosphorous. In general, the risk of phosphorous contamination is greatest in areas of shallow soils over fractured bedrock and in coarse-textured soils with limited adsorption capacity. Increased horizontal isolation of the system is also an important design factor in limiting phosphorous migration because of the greater and more prolonged contact with soil particle surfaces.

Beyond establishing the location of the final dispersal system which meets or exceeds minimum horizontal isolation established in Table 4.1, each site should be further evaluated for the potential risk based upon site specific conditions and other factors that may include the following:

1. Anticipated flow volume.
2. Pre-treatment to reduce phosphorous prior to discharge to the soil-based dispersal system.
3. The natural capacity of the soils to uptake phosphorous and the total volume of soil that the wastewater will contact.
4. Direction of groundwater flow, the rate of water movement and high groundwater elevation fluctuation.

In general, the risk associated with phosphorous will increase with the flow volume and proximity to surface water. For systems with flows exceeding 6,000 gpd the agency shall be consulted as to the need for a site specific evaluation where the final dispersal system will be within 500 feet of surface waters.

Chapter 8 – Treatment System Objectives

8.1 Treatment System Design Concepts

Once the waste strength and site have been adequately characterized, consideration needs to be given to the overall design of the treatment system inclusive of soil dispersal which will address the waste and site conditions. All systems must adequately protect the environment and public health. The overall compliance criteria in Table 8.1 apply to all treatment systems with subsurface dispersal. Once the design concept has been selected, then a detailed design of the system's specific components must be submitted. The design is to be reviewed in accordance with standards and guidance prescribed herein.

Table 8.1
Treatment System Compliance Criteria

Compliance Measure	Compliance Criteria	Applicable to:
Site Suitability	Site must meet all requirements of Chapter 5.	Undeveloped or developed site under consideration
Protection of Groundwater and Surface Water	Treatment and dispersal system must be designed, constructed operated and maintained to meet all minimum requirements of the criteria.	Entire system
No direct exposure to wastewater or effluent from collection treatment and dosing components.	Design and construction must exclude exposure to sewage or effluent.	All collection, treatment and dosing devices
No direct exposure to sewage effluent from soil-based dispersal system.	No exposed sewage surface discharge or surfacing of effluent.	Soil-based dispersal system
Hazardous/Industrial Wastes excluded from discharge.	No hazardous or industrial waste allowed into system.	Influent
Non-domestic Wastewater.	Waste must be of domestic equivalent strength and suitable for treatment and groundwater discharge.	Influent
Operation and Maintenance.	Operated per manufacturer’s recommendations, management plan and/or discharge permit conditions.	Entire system
Safety - Free from physical injury and harm.	System designed, constructed, operated and maintained to eliminate potential for personal injury: confined space, drowning, electrocution, falling, etc.	Entire system
Must meet all state, local and federal requirements.	Comply with all other applicable requirements.	Entire system - compliance oversight by responsible agency

8.2 Treatment Objectives

Every system must also accomplish a minimum degree of treatment of the influent waste stream prior to discharge to the soil-based dispersal system. Today's on-site treatment technology ranges from conventional septic tank with effluent filter to advanced tertiary treatment systems with nutrient removal and/or disinfection. For the purpose of the criteria the following minimum treatment objectives are defined:

Table 8.2
Treatment Objectives

Treatment Objective	BOD_5 (mg/l)	TSS (mg/l)	FOG (mg/l)	TIN. (mg/l)	PO_4-P (mg/l)	Fecal Coliform[a]
FP	140	55	20	50[b]	------	-----
ST	30	30		-----	------	-----
TT	10	10		-----	------	-----
NR	10	10		20 / 40[c]	------	-----
EBNR	10	10		10 / 20[c]	------	-----
PR	10	10		-----	2	----

FP - Filtered Primary - basic septic tank effluent quality.
ST - Secondary Treatment
TT - Tertiary Treatment
NR - Nitrogen Reduction
EBNR - Effluent Based Nitrogen Removal (10 mg/l TIN limit)
PR - Phosphorous Reduction

a – The determination for fecal coliform limits/disinfection is based on case-by-case evaluation of risk to surface or groundwater
b – Ammonia (Total Kjeldahl Nitrogen = 90 mg/l)
c – Monthly average / 7-day average
All values in Table 8.2 reflect the monthly average unless otherwise noted.

8.3 Treatment Selection Based On Vulnerability

Every project will have specific site characteristics and limitations that will need to be met for the quantity and quality of wastewater coming from the facility. These characteristics will determine the degree of treatment necessary by the treatment system components prior to soil dispersal. Table 8.3 establishes the minimum treatment system objective based upon these factors and an assessment of groundwater and/or surface water vulnerability (Low, Medium or High). Approval should only be granted where the treatment objective can be achieved.

Table 8.3
Determining Treatment Objective Based on Vulnerability

FLOW (gpd)→	0-1000			>1000-6000			>6000-10000			>10000-20000		
GROUNDWATER VULNERABILITY→	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**
WASTEWATER CHARACTER – Domestic	FP	FP	FP or NR	FP	ST	NR	ST	NR	NR	ST	NR	NR
WASTEWATER CHARACTER – High Organic	FP	FP	NR	FP	NR	NR or EBNR	ST	NR	NR	ST	NR	NR
WASTEWATER CHARACTER – High Nitrogen	FP or NR	FP or NR	NR	FP or ST	NR	NR or EBNR	NR	NR	EBNR	NR	NR	EBNR
SURFACE WATER VULNERABILITY→	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**
	--	--	PR	--	--	PR	--	PR	PR	--	PR	PR

L = Low
M = Medium
H = High

Treatment Objective:
FP - Filtered Primary - basic septic tank effluent quality.
ST - Secondary Treatment
TT - Tertiary Treatment
NR - Nitrogen Reduction
EBNR - Effluent Based Nitrogen Removal (10 mg/l TIN limit)
PR - Phosphorous Reduction

Chapter 9 – Alternative Treatment Technologies

9.1 Non-proprietary Technology (public domain)

Non-proprietary technologies include any wastewater treatment or distribution technology, method or material not subject to a patent or trademark which significantly contributes to the attainment of the treatment objectives. Such technologies are designed and built in accord with generally accepted practice pursuant to specific technical guidance provided by the department or other generally accepted technical guidance recognized by the department.

9.2 Proprietary Treatment Technology

Proprietary treatment technology include any treatment product held under patent or trademark which significantly contributes to the treatment performance and attainment of effluent quality objectives as indicated in Table 8.2, Minimum Treatment Objectives. The system designer shall verify to the satisfaction of the agency that the proprietary product can be expected to meet treatment objectives for the defined wastewater characteristics and site conditions. Verification shall be supported by the following information:

1. Manufacturer: name, mailing address, street address and phone number;
2. Manufacturer Contact: individual's name, mailing address, street address, and phone number. The contact individual must be vested with the authority to represent the manufacturer in this capacity;
3. Name, including specific brand and model, of the proprietary treatment product;
4. A description of the function of the proprietary treatment product along with any known limitation on the use of the product;
5. Product description and technical information, including process flow drawings and schematics; materials and characteristics; component design specifications; design capacity, volumes and flow assumptions and calculations; components; dimensioned drawings and photos;
6. Detailed description, procedure and schedule of routine service and system maintenance events;
7. Copies of product brochures & manuals: *Sales & Promotional; Design; Installation; Operation & Maintenance; and Owner Instructions, etc.*;
8. The most recently available product test protocol and third party results report;
9. A signed and dated certification by the manufacturer's agent specifically including the following statement language:
   "I certify that I represent (INSERT MANUFACTURING COMPANY NAME) and I am authorized and do hereby attest, under penalty of law, that this document and all attachments are true, accurate, and complete. I understand and accept that the product testing results reported with this application for registration are the parameters and values to be used for determining conformance with Treatment Objective (INSERT APPLICABLE OBJECTIVE). We have reviewed the intended usage of our product for this defined wastewater characteristic and are supportive of installation";
10. A list of representatives and/or manufacturer certified installers and service providers.

11. A signed copy of the maintenance contract with a certified maintenance provider for a minimum of three (3) years.

9.3 Technology Listing

The Department shall maintain a listing of non-proprietary technologies along with specific guidance on design and usage. The non-proprietary technology listing and guidance shall be made available on the Department's website.

The Department shall also maintain, and make available on its website, a database which includes specific listing and description of projects that have been approved involving non-proprietary and proprietary treatment technologies. The listing shall include information describing the required treatment objective, treatment technology, facility wastewater characteristics, operation and maintenance requirements and documented field performance (as available).

Chapter 10 – System Management

10.1 System Management Plan

The owner of the on-site wastewater system is responsible for ensuring that the system is monitored, inspected, serviced and otherwise maintained after construction. Routine and proper operation and maintenance ensures that the system will perform as designed thereby protecting public health and the waters of the state. For any system designed and approved for subsurface dispersal under the criteria a draft system management plan shall be included in the overall plan submittal. The final system management plan shall be made available to the department for approval prior to initial operation of the system.

10.2 System Management Plan Content

The system management plan shall include all necessary information and procedures for maintenance to allow the system to reliably function as designed and approved. The system management plan details will vary on a site by site basis depending upon the nature of the facility, the type of treatment, and method of final dispersal. In general, management oversight increases as wastewater flow, strength and level of treatment prior to dispersal increases. In addition to a copy of the as-built construction plan, the management plan should include but not be limited to the following, as appropriate:

1. A general description of the overall treatment and dispersal system, operation, and proper use.
2. A copy of the current operating permit or discharge authorization.
3. Start-up and shut-down procedures.

4. Meter monitoring, sampling (e.g. sample frequency, sample location, sample analytical units needed, etc.) and reporting procedures.
5. Accumulated wastewater solids monitoring and removal procedures.
6. Servicing frequency of key treatment and dispersal components.
7. Detailed specifications and specific maintenance schedules for any mechanical treatment system components.
8. Manufacturer’s mechanical equipment and/or control settings.
9. Contingency plan due to malfunction of system components.
10. Contact information for system owner, service providers and regulatory agencies.

The owner shall review the approved Management Plan periodically and update as necessary.

10.3 System Management Oversight and Reporting

Table 10.1 indicates the minimum system management and reporting objectives deemed appropriate based upon overall treatment system classification and design flow. These objectives can vary due to site specific concerns and/or treatment technology. Furthermore, established local regulations may have additional or more stringent reporting requirements that must be met.

Table 10.1
System Management and Reporting Objectives

System Classification	System Description	Operating Permit and/or Maintenance Contract	Minimum Reporting Frequency	Qualified Maintenance Provider*
Conventional	System with flows <1,000 gpd with non-uniform dispersal of FP effluent to soils.	Recommended	Self monitoring and Records. Complete System Evaluation Every five (5) years.	Owner Oversight
	System with flows <1,000 gpd with non-uniform dispersal of high strength septic tank effluent to soils.	Maintenance Contract	Annual	Yes
Alternative	Systems with flows <1,000 gpd with uniform dispersal of FP effluent to soils via pressure distribution, drip irrigation, etc. only.	Recommended	Self monitoring and Records. Complete System Evaluation Every five (5) years.	Recommended
	Systems with flows >1,000 gpd and <6,000 gpd with uniform dispersal of FP effluent to soils via pressure distribution drip irrigation, etc. only.	Recommended	Annual (Recommended)	Recommended
	Systems with flows ≤1,000 gpd incorporating enhanced treatment.	Operating Permit & Maintenance Contract	Annual	Yes
	System with flows ≥1,000 gpd and <6,000 gpd incorporating enhanced treatment.	Operating Permit & Maintenance Contract	Semi-Annual	Yes
	System with flows ≥6,000 gpd and <20,000 gpd incorporating enhanced treatment.	Operating Permit & Maintenance Contract	Quarterly	Yes
	Wastewater Reuse/Recycle systems	Operating Permit & Maintenance Contract	Monthly	Yes

*See Section 10.4

10.4 Qualified Maintenance Providers

The performance of operation and maintenance activities should only be undertaken by those qualified individuals who possess adequate training and experience related to the specific treatment and dispersal system. It is the system owner’s responsibility to retain the services of such qualified individuals to conduct/document necessary routine operation and maintenance activities. The department may require these individuals to become certified operators pursuant to statute and rules to demonstrate they are properly qualified to operate the facilities. Additionally, specific training and certification programs administered by proprietary equipment manufacturers or other third party organizations may be considered. The qualified individual shall be identified in the management plan.

Chapter 11 – Tank Design and Construction

11.1 Location

Tanks shall be located:

1. Where they can be accessed easily for septage removal and other service requirements.
2. Away from drainage swales or other depressions where water can collect. Final soil cover over the tank(s) shall be finished as to divert surface flow patterns away from the tank. Non-sewage discharges (e.g. roof downspouts, water softeners, sump pumps, etc.) shall not be allowed near the tank area. Nor, shall any of these discharges be routed into the tank.
3. Where the minimum horizontal setback distance is obtained from buildings, property boundaries, wells, water lines, etc. pursuant to Table 4.1.
4. Where there is minimal risk from vehicular traffic. If vehicular traffic is a concern, the tank shall be engineered for the intended load.
5. Above saturated soil whenever possible. If tanks are installed below saturated soils, they shall be designed and installed to protect against flotation when empty, per manufacturers recommendations.

11.2 Tank Construction

Tanks shall be:

1. Watertight (see Section 11.7).
2. Constructed of durable material that is resistant to excessive corrosion and deformation from external soil and internal load pressures.
3. Structurally engineered for the depth of bury. Tanks shall adhere to applicable industry standards.

11.3 Tank Sizing and Geometry

11.3.1 Septic Tanks

Septic tanks shall have the following design:

1. Have a minimum size of 1,000 gallons, regardless of flow.
2. Have an effective liquid capacity sufficient to provide a minimum retention time of 2-times the peak design flow if wastes are of typical domestic strength.
3. The length to width ratio shall be no less than 3:1, or so partitioned as to provide protection against short-circuiting of flow. This minimum ratio allows for the flotation and settling processes to occur.
4. The water depth shall be no less than four (4) feet to provide an adequate zone for the separation and stratification of raw waste materials into three zones within the tanks commonly referred to as scum, sludge and clear effluent zones.
5. When design flows are greater than 1,000 gpd, tank partitioning or multiple tanks must be utilized. The first compartment or tank in a series must have a greater volume than any following compartment or tank. It is recommended that the first compartment have a capacity of one-half to two-thirds of the total volume required.
6. When the tank has compartments, flow between compartments can occur in the baffle wall via piping located in the clear zone of the tank (mid-depth of tank). Adequate venting must be provided between compartments.
7. Have adequate tank volume prior to a proprietary treatment unit in compliance with the manufacturer’s requirements.
8. Although not recommended, if a tank has sewage inflow from a pumped source (e.g. lift station) the minimum retention time shall be 4 times the peak design flow.

11.3.2 High Strength Waste Tank Considerations

1. For high strength waste, grease interceptor tanks shall have an effective liquid capacity sufficient to provide a minimum retention time of 3 times the peak design flow.
2. For high strength waste, a larger tank volume of 3 to 4 times the peak design flow should be provided. Increased tank volume alone may not reduce the waste strength to that comparable to domestic wastewater. However, more tank volume and/or multiple tanks may aid in the reduction of FOG.

11.4 Tank Inlet and Outlets

11.4.1 Tank inlet and outlet piping

Tank inlet and outlet piping shall:

1. Locate the outlet pipe at minimum two (2) inches lower than the inlet pipe.
2. Attach the inlet and outlet pipe to the tank in a watertight manner using a flexible gasket or boot.
3. Be constructed in a manner to allow proper venting of gasses.

11.4.2 Tank Outlet Baffles

1. Be installed to prevent the scum layer from exiting the tank. The baffle must extend into the clear zone of the tank, typically into the middle third of the liquid depth.
4. Include an effluent filter in the outlet baffle in a single tank installation or the outlet of the last tank in series.
5. Adequately size the effluent filter for the design flow.
6. Consider an inlet baffle (not required) or other method of energy dissipation when raw sewage is being pumped into a tank to minimize disruption to the scum layer. The inlet baffle should not extend as deep as the outlet baffle.
7. Be installed so that there is an air gap (for venting) between the top of the baffle and the underside of the tank lid.

11.5 Access Risers and Lids

Risers are required on all tank openings that require access for any maintenance activity.

Access risers shall:

1. Have (at minimum) an opening over the inlet pipe/baffle and over the outlet baffle or effluent filter. Additional openings shall be provided over any tank baffle wall that contains a baffled outlet port. Large tanks require additional openings to allow ample ability to pump out tank contents and for inspection. Opening size shall be a minimum of 24 inches. For deeper tanks or duplex pump installations a larger diameter riser may be warranted.
2. Be corrosion-resistant, watertight, and maintain structural integrity.
3. Be constructed of durable materials such as concrete, PVC, fiberglass, or high density polyethylene plastics." Lids should be heavy enough to prevent access by children, or otherwise be secured to prevent unauthorized access. If screws are used to secure the lid, stainless steel screws are required. Typical Phillips-head or slotted-head screws are not recommended. Screws with hex heads or other designs that require a special tool to remove them are recommended.
4. Have a watertight connection between the riser and tank. Manufacturer's installation requirements shall be followed.

5. Contain an adequate seal at the riser lid to prevent the escape of gases, water infiltration and intrusion by vermin.
6. Minimize the potential of a riser lid flipping or dislodging when stepped upon.
7. Install a secondary safety device (recommended vs required) in the riser to prevent an accidental fall into the tank should the riser lid become unsecured.

11.6 Tank Installation

Septic tank(s) shall be installed:

1. To rest on a uniform bearing surface. It is good practice to provide a level, compacted granular base such as coarse sand or pea stone for the tank bedding. The underlying soils must be capable of bearing the weight of the tank and its contents when full. Soils with a high organic content or containing large boulders or massive rock edges are not suitable, unless properly prepared.
2. To meet all manufacturer's specifications.
3. To have the tank excavation carefully planned to avoid over digging around the parameter of the tank, except as necessary for the safety of workers. Unless it is done carefully, backfill operations can result in damage to the tank and pipe connections. The system designer shall ensure excavations are conducted in a safe manner.
4. Using backfill material of a granular nature free of stones larger than three (3) inches in diameter, debris, ice, or snow. Fill should be added in lifts no greater than 12 inches and each lift well compacted. For fine-textured native soils (e.g. silts, silt loams, clay loams, and/or clay) imported granular material should be used. This is a must where freeze and thaw cycles are common because the soil movement during such cycles can work tank joints open. When using plastic and fiberglass tanks, strict accordance to the manufacturer's bedding and backfill requirements must be followed.
5. To protect against flotation when empty. Tank manufacturers should be consulted for appropriate anti-flotation methods or devices.
6. Using joint sealant conforming to ASTM C990.

11.7 Tank Watertightness Testing

Watertight, structurally sound tanks are essential to the performance of onsite wastewater systems. Wastewater that leaks out of a septic tank that is not watertight may not be adequately treated and can contaminate ground and surface waters. In addition, infiltration of the ground water into a leaky tank can hydraulically and organically overload the downstream components of the treatment system. Field testing for watertightness is essential for ensuring that a tank will adequately contain wastewater.

Septic tanks and pump-dose tanks shall be tested for watertightness using either a vacuum test or water test.

Chapter 12 – Pumps, Controls and Appurtenances

12.1 General

Dosing and pressure distribution are standard practices for subsurface dispersal and many other secondary treatment processes. The primary method for dosing and distributing effluent is with a pump. Pumps are also utilized in conjunction with flow equalization facilities.

Typical applications utilize submersible pumps designed specifically for raw wastewater or effluent. Raw sewage applications will utilize non-clog submersible wastewater pumps designed specifically for this application. Effluent pumps are available in many models and styles, from single-stage centrifugal pumps to multistage turbine pumps. The advantages/disadvantages of using one pump type over the other must be considered by the system designer and pump selection made based upon the intended application.

Pump selection is made by determining the total dynamic pumping head (TDH) in feet of pressure for the design pumping rate. The system total dynamic head calculations, pump rate (gpm) basis of design and pump curves must be included with the submittal for review and approval.

12.2 Raw Sewage Pumping

Raw sewage pumps are normally used in lift stations in conjunction with gravity collection systems before treatment works to move raw, unsettled wastewater. Sewage pumps are also used to eject raw wastewater from a lower elevation such as a basement. In general the practice of pumping directly into septic tanks is discouraged. The use of grinder pumps for raw sewage ahead of septic tanks should be avoided. Grinding sewage into a slurry of small particles is thought to affect normal settling and digestive processes. If pumping of raw sewage cannot be avoided, additional measures must be included in design to mitigate negative effects, primarily surging and turbulence, on overall treatment system performance. Options that may be considered include:

1. Pumping to gravity sewer some distance upstream of the septic tank instead of directly to the septic tank.
2. Install an inlet baffle in the septic tank to deflect the inlet discharge rather than across the tank.
3. Install more septic tank capacity or a surge tank prior to the septic tank.
4. Install multiple septic tanks in series or compartmented septic tanks.

12.3 Time Dosing

Current and best practice recognizes the importance and benefit of keeping the dosing periods short to reduce instantaneous hydraulic and organic loads. Short doses followed by extended resting periods spread throughout the day enhance microbial activity and improves treatment. From a dispersal standpoint, time dosing when combined with pressurized distribution has the ability to improve treatment system longevity by means of spreading the load in smaller, discrete volumes and more uniformly over the treatment area. Control of pumping units by means of programmable timers is preferred. Time dosing is strongly encouraged for all systems whenever a pump is used to dose a soil absorption system. Timed dosing in conjunction with pressure distribution is required for all soil absorption systems over 1,000 gpd.

Time dosing also provides a means of protecting the treatment system from leaking plumbing fixtures (i.e. leaking toilet) and infiltration. Should the volume within the dosing tank exceed the design surge volume, a high level alarm will activate.

12.4 Demand Dosing

Discharge of wastewater or effluent with demand dosing provides for delivery of hydraulic and organic loads which more closely match diurnal flow patterns rather than distribution over time uniformly. Demand dosing delivers flows to downstream components in periodic amounts as controlled by the dosing tank liquid level only. While acceptable, demand dosing is not encouraged in situations where dosing is required. Unless flows are carefully monitored, demand dosing will not provide protection of the system from leaking fixtures and infiltration, unlike time dosing.

12.5 Distribution Valves

Pump sizes may be kept smaller, even for large systems, by dividing the distribution system into “zones” with the use of hydraulic sequencing valves. Such valves permit a small portion of the system to be dosed at any one time, while the remaining zones rest. Like an underground irrigation system, the valve rotates from zone to zone during pump cycles. Small doses with intermittent resting can optimize treatment performance. Other advantages include the use of smaller pumps, smaller diameter pipe network, and more uniform effluent distribution on slopes. The system designer must be familiar with the proper installation and operation of such valves, and show installation details and specifications on construction plans. A description of the necessary operation and maintenance of these components needs to be included in the O & M Manual for the system.

12.6 Number of Pumping Units

Wherever continuous service without interruption is necessary or desired, pumping installations must include a minimum of two alternating pumping units each equipped to discharge at the design flow rate. The requirement for two pumping units may be waived where wastewater flow can be interrupted temporarily without causing a danger while repairs are made (i.e. where a bathroom can be temporarily closed) or where sufficient emergency storage volume has been designed into the system.

12.7 Pump Controls and Electrical Components

The controls and sensors ensure the system will operate efficiently and sound an alarm when malfunctions occur. The controls, therefore, need to be of sufficient quality that will ensure the long-term reliability expected of permanent systems. To ensure this, control and alarm panels need to be listed by an accredited agency (e.g., UL or CSA); their components need to be listed or recognized by the same accrediting agency.

12.7.1 Basic Controls

Basic control functions that need to be provided for all pumps include:

1. HOA switch --- “Hand, Off & Automatic”;
2. Audio/Visual high-water alarm & overrides;
3. Elapsed time meters and pump event counters;
4. Circuit protection;
5. Electrical disconnect;
6. Motor contactor; or
7. Locking enclosure

12.7.2 Other Controls

Other control functions that may be appropriate include:

1. Low-water alarms and redundant “pump off”;
2. Programmable timers for dose control operations;
3. Surge arrestor;
4. Current sensor; or
5. Manual alarm resets

12.7.3 Pump Control Panels

Control/alarm panels must be installed at an above grade location that is convenient and accessible for maintenance. They must be located near and within sight of the pump(s) and protected from the elements and have a locking enclosure appropriately rated for the environment.

12.7.4 Pumps and Electrical Hookups

Pumps and electrical hook-ups must conform to all state and local electrical codes, as follows:

1. Pumps and controls should have gas-tight junction boxes (splice boxes) and have electrical disconnects (as per National Electric Code) appropriate for the installation.
2. Splice boxes should be placed so that they do not interfere with the servicing of other components. The splice box, cord grips and appurtenances must be non-corrosive and rated as water resistant with an accredited agency (e.g. UL or CSA).
3. Conduit installed between the pumping chamber and/or splice box and the control panel shall have water tight joints and shall include an approved sealing method to prevent the migration of gasses or moisture into the controls.

12.7.5 Pump Floats and Switches

For all pumping systems the following requirements should be satisfied:

1. Floats should always be securely attached to a separate support stem designed for that purpose and not attached to the pump discharge pipe. Floats or other level sensors need to be impact resistant, constructed of non-corrosive materials, watertight and listed for water and sewage with an accredited agency (e.g., UL or CSA).
2. Float settings need to be adjusted to ensure that the pump motors remain submerged at all times. A redundant off float switch may be required to ensure submergence of the pump motors and to keep the pump(s) from running dry.
3. The motor cord is listed in accordance with the NEC for extra-hard usages (SO).
4. The use of pump switches built into the pump, or affixed to the pump, by the manufacturer should not be used in a wastewater system.

12.8 Pump Installation and Fittings

All pumps and valves must be installed so that they can be easily removed and/or replaced from the ground surface. Under no circumstances shall pump replacement and/or repair require service personnel to enter the pump tank.

Pumps must be fitted with unions, valves and electrical connections deemed necessary for easy pump removal and repair. Lift chains or rope must be of size and strength to allow safe pump removal. Lift chain shall be stainless steel or other non corrosive material. Lift rope must be of material that will not be subject to deterioration in a wastewater environment.

All effluent pumps must be suitably protected against clogging, normally by approved septic tank outlet screens or by screened pump vaults. Pump vaults provide the added benefit of suspending the pump off the bottom of the pump tank, allowing room on the bottom for biosolids to accumulate without being picked up by the pump and discharged to the soil absorption system. Most vault designs also hold floating scum in the tank as well. Pump vaults or effluent screens must be well maintained as part of routine operation and maintenance.

If any portion of the pump fittings or transport line is at a higher elevation than the drainfield, the system must be equipped with an air vacuum release valve or other suitable device to avoid siphoning.

If a weep hole is used in the forcemain inside the pump chamber to allow drainback, the system designer must factor the volume of drainback of the transport line into the dosing volume design. This is also necessary when a check valve is omitted in the pump discharge piping. It may also be necessary to consider the quantity of discharge through the weep hole when determining pump run times. All of this becomes more important as the length and diameter of the transport line increases.

12.9 Effluent Pump Selection

Effluent pumps are generally one of two types - submersible centrifugal pumps or multi-stage high-head turbine pumps. Each type of pump is more suitable for certain types of applications. The difference is typically in the head against which the pump is capable of operating. Turbine pumps will generally pump against much higher heads than centrifugal pumps; which is advantageous when the system may experience increased back pressure during its operation (i.e. the clogging of orifices in a pressure-distribution network). In general, multi-stage high-head turbine pumps produce less flow, but more head (steep curve). In contrast, single stage centrifugal pumps generally produce more flow with less head (flatter curve). The system designer needs to refer to the specific head curve for the chosen pump for pump selection and performance information.

Submersible turbine pumps may also require a draft tube to route flow past the pump motor for cooling. Other specific installation requirements may also be recommended or required by the pump manufacturer so as not to void the warranty.

12.10 Remote Monitoring

Remote monitoring capability installed in conjunction with controls gives wastewater system operators and service providers the ability to remotely monitor and control performance from an off-site location. This results in more reliable and effective operation and maintenance by service providers. An additional benefit is the capability to provide immediate notification of the operator in the event of an alarm condition at a system. This capability has its advantages for all systems, but is required for all community systems and in general for those utilizing alternative treatment systems more complex than simple pressure distribution. Exceptions may be considered for facilities employing full time on-site maintenance personnel.

Among the remote monitoring capabilities that can be provided are:

1. Automatic alarm notification to operator(s).
2. Self-adjusting based on trend data.
3. Remote access to change control settings.
4. Data logging for access to historical data for troubleshooting problems.
5. Data logging for access to historical flow data.
6. Detection of high/low liquid levels, stuck float switches, pump failures, excessive cycles/run times, clogging, and many other conditions.

12.11 Flow Measurement

The ability to collect and record accurate flow data is an essential tool to optimize the treatment process and comply with treatment objectives. Collection, review and reporting of flow data by the system operator allows for preventative trouble shooting and adjustments to be made based on real time data for the treatment system. Basic flow data can be obtained with any system using pump event and pump run-time records, and should be included as part of the system management plan. Where flow meters are used they should be meters which do not incorporate paddle wheels, turbines or other protrusions into the flow stream, and should be designed specifically for wastewater applications.

12.12 Use of Wastewater Siphons

Siphons have been used in the past and occasionally today for dosing of larger drainfields, usually in combination with larger diameter (4" or larger) drainfield piping. Siphons offer the advantage of dosing without the need for electrical service or pumps. However, siphons are not effective when trying to use small diameter pipes and orifices for uniform pressure-distribution for the following reasons:

1. Siphons rely upon gravity flow to work properly, and in many cases, site elevations do not allow sufficient head to achieve an adequate pressure in drainfield distribution piping.
2. Siphons do not have the ability to generate higher pressures in the event of orifice clogging.
3. Siphons cannot generate the required pressure necessary for routine lateral flushing, a necessary pressure-distribution system maintenance practice.

Therefore, siphons should almost never be used in connection with pressure-distribution systems and/or small diameter orifices. If used, a dosing event counter should be incorporated in the design so the operator can monitor whether the siphon is working properly. The system management program should provide for the regular inspection of the siphon operation.

Chapter 13 – Flow Equalization

13.1 Introduction and Application

Flow equalization is the process of reducing the variability of the influent flow and waste strength to a system component over time by storing peak flows and metering their release at a predetermined rate to approximate the average daily flow or, in some cases, the average over several days. In general, both conventional and alternative treatment technologies are designed to work within a range of hydraulic and organic loads. Extreme variations in flow rates and wastewater concentrations can seriously complicate the treatment processes. All systems must be designed to handle periods of high flow or high waste concentrations and still be able to provide sufficient biochemical treatment to the discharged wastewater. Flow equalization can dampen these variations, allowing for a constant or near constant flow and waste strength delivery to a treatment component. Providing equalization storage volume can be cost effective since tankage is usually the least costly component. Equalizing flow just prior to discharge to the final dispersal system may also be considered to allow for design and construction of the dispersal component based upon an equalized flow rate.

Flow equalization is useful and may be considered for the following types of facilities:

1. Banquet/rental halls
2. Churches
3. Festivals, flea markets
4. Offices
5. Schools
6. Stadiums
7. Or other facilities where equalization of daily diurnal flow or waste strength patterns would optimize the treatment system performance.

13.3 Flow Equalization Terminology

For the purposes of clarification:

1. Equalized Daily Flow – The total volume of wastewater generated by flow events at the facility during the flow equalization cycle divided by the number of days in the cycle.
2. Flow Equalization Cycle – The time period in which wastewater will be stored and dosed. Example 1-day cycle, 7-day cycle, 14-day cycle, etc.
3. Flow Event – An event in the flow equalization cycle in which wastewater will be generated. Examples: church service, sporting event, day of operation, etc.
4. Flow Balance – A daily account of the amount of stored effluent in the equalization tank which is derived from the incoming flow, residual storage, and the outgoing flow. The flow balance identifies the day of the week, the amount of wastewater generated, the amount of wastewater dosed, and the residual amount of effluent left in the dosing tank each day. At the end of the flow equalization cycle, the sum of the amount dosed should equal the sum of the incoming flow.

5. Equalization Storage Volume – The calculated maximum residual storage volume over the equalization cycle; plus a 20% or greater factor of safety. The system designer shall choose a factor of safety and show in his/her calculations the factor used in sizing the system.

13.4 Placement of Flow Equalization

The placement of flow equalization can occur at various locations in the treatment scheme, depending upon the design of treatment works. If septic tanks are the means of primary treatment, then the equalization volume is normally located downstream of a septic tank with capacity as required by Chapter 11. The actual location of the storage will be a decision by the system designer based upon a consideration of site conditions, treatment system design and overall cost effectiveness. Using a fluctuating water level in the septic tanks used for treatment and solids storage should only be done in exceptional cases, and only for the smallest of systems. When flow equalization is used, the downstream treatment components following storage would then be designed based upon the equalized daily flow.

13.5 Establishing Equalization Storage Volume

Flow variability typically occurs monthly, daily, hourly or due to special events. For other facilities establishing equalization volume requires an evaluation of flow patterns over the equalization cycle. When possible, actual recorded flow data should be utilized. Otherwise, methods that reliably estimate expected daily flows and usage patterns may be considered.

The system designer will be responsible for providing a mass balance of flow over the equalization cycle in support of the system design. The mass balance shall estimate the specific daily flow into storage, the controlled flow out of storage, and the storage required at any time during the cycle. Plan details and specifications shall then reflect how this storage is to be provided, with specific dimensions, elevations and tank volumes.

Example (Church):

Project: 200-seat church with a full service kitchen. The daily design flow is five (5) gallons/seat. The site has a clay soil (Group IV). The church has services on Sunday and Wednesday with extracurricular events (e.g. weddings, reunions, suppers, etc.) on Saturdays. Sunday attendance: 200 members; Wednesday attendance: 100 members and Saturday events: 200 members.

Attendance /Daily Flow	
Sunday (200 members)	1000 gallons
Wednesday (100 members)	500 gallons
Saturday (200 members)	1000 gallons
Weekly Total:	2500 gallons

Equalization cycle is 1 week (7 days)

Equalized Daily Flow: 2500 gallons/7 days = 358 gallons/day

Flow Balance Calculation:

Day	In (gallons)	Out (gallons)	Residual (gallons)
Saturday	1000	358	642
Sunday	1000	358	1284**
Monday	0	358	926
Tuesday	0	358	568
Wednesday	500	358	710
Thursday	0	358	352
Friday	0	358	0
Total:	2500	2506	0

The equalization storage volume is the greater of the peak daily flow* (1000 gallons) or the calculated maximum residual** (1284 gallons) plus a 20% factor of safety.

Therefore, for this example:

Equalization storage volume = 1284 gallons X 1.2 = 1540 gallons

The equalization tank must be large enough to provide this gallon volume plus additional volume to allow for pump submergence.

13.6 Equalization Pump Control

All equalization facilities shall utilize a minimum of two alternating pumps. Pump control shall be accomplished by means of programmable timers with settings to discharge the equalized daily flow. Controls shall include a high water alarm to be signaled at or above the equalization volume level in the tank. A low level alarm/redundant off capability shall also be provided.

13.7 Distribution of Final Effluent to Soil Dispersal

Pressure distribution shall be utilized where design flow exceeds 1,000 gpd.

Chapter 14 – Dispersal System Design and Construction

14.1 Introduction

The soil dispersal portion of an on-site system is a key element in having a long-term, properly functioning system. A variety of design options are detailed below for the system designer's consideration. It is important for the system designer to utilize distribution components and methodologies that are appropriate for the strength and volume of wastewater produced by a facility. The objective in any soil dispersal system design is to maintain a consistent aerobic soil environment. The utilization of pressure distribution providing controlled, equally distributed doses of effluent is preferred in most cases. This allows for a well balanced aerobic ecosystem to flourish within the soil environment offering better long-term treatment results and overall system longevity.

14.2 Distribution Systems and Components

Item	Standard
Building Sanitary Lead	Designed and constructed per applicable plumbing codes
Slope of Sanitary Lead	Excessive slope considerations

14.3 Septic Tank Effluent Pipe (for gravity flow)

Item	Standard
Pipe	Solid Schedule 40 PVC or equivalent
Joints	Water-tight connections
Slope	Min 1% laid on compact base material

14.4 Distribution Boxes

The distribution box connects a single effluent line from the septic tank to a network of dispersal piping or components. The distribution box outlet design should allow for adjustment to the flow among the various absorption lines, compensating for a slightly tipped box, differences in dispersal line length, or differences in dispersal line condition.

Item	Standard
Construction Material	Durable and resistant to corrosion
Distribution Box Footing	Compacted sand, or gravel to prevent

	differential settling
Water-tight Pipe Connections	Required per manufacture specifications
Flow Dialers or Adjusters	Required
Accessible Cover	Required
Pumping Into Distribution Box	Discharge must be directed away from an outlet pipe and must not overflow the box TED TO PROVIDE ADDITIONAL LANGUAGE

14.5 Gravity Distribution Bed

Gravity Distribution Bed systems shall be limited to facilities having an established design flow less than 1,000 gal/day.

Item	**Recommendations**
Pipe Size	4-inch utilizing same wall thickness standards between perforated and non-perforated.
Perforated Pipe	Maximum 2 square inches/lineal foot in lower 150˚ of arc of pipe
Header	D-box recommended, otherwise level solid pipe (nonsweeping tees) on a supportive base material
Footer	Perforated pipe tied into all laterals
Lateral Length	100 ft maximum
Lateral Slope	Level to a maximum of 2-inches per 100 feet
Stone Under Pipe	Min of 6-inches
Stone Over Pipe	Min of 2-inches
Space Between Laterals in Bed	2-ft minimum to a maximum of 6 ft
Space Between Sidewall and Distribution Pipe	1ft
Soil Barrier	Required. Non-woven geotextile fabric. Less than 2 oz/yd2, 10# minimum tear, 8# min puncture
Final Soil Cover	Sandy loam to loamy sand with thin layer of topsoil to establish vegetative growth. Total thickness to range from 4-inch minimum to 24-inch maximum.
Inspection/Observation Ports	Required and installed to base of stone
Surface Drainage	Divert away from system

14.6 Gravity Distribution Trench

Gravity Distribution Trench systems shall be limited to facilities having demonstrated flow less than 1,000 gpd. The uses of gravity trench systems are preferred over gravity bed systems.

Item	Standard
Pipe Size	4-inch utilizing same wall thickness standards between perforated and non-perforated.
Header	D-box recommended, otherwise level solid pipe (nonsweeping tees) on a supportive base material
Footer	Perforated pipe tied into all laterals
Lateral Length	100ft maximum
Lateral Slope	Level to a maximum of 2-inches per 100 feet
Stone Under Pipe	Min of 6-inches
Stone Over Pipe	Min of 2-inches
Trench Bottom	Level
Trench Bottom on Sloped Sites	Level following the contour
Trench Width	1 ft to 3 ft.
Space Between Trenches (stone to stone)	4 ft
Soil Barrier	Required.
Final Soil Cover	Sandy loam to loamy sand with thin layer of topsoil to establish vegetative growth. Total thickness to range from 4” minimum to 24” maximum
Inspection/Observation Ports	1 per trench to base of stone

14.7 Final Cover and Grading

A minimum of 4-inches and a maximum of 24-inches of suitable earth cover shall be placed over the absorption system. Suitable earth cover means a permeable soil that will allow aeration and that will support the growth of grass. Sandy loam soils are preferred. Loam or heavier soil textures shall be prohibited. The surface must be graded such that, water will not pond on the system. Vegetative cover over the drain field should be established as soon as possible after construction in order to prevent soil erosion and promote aerobic conditions within the treatment area.

14.8 Low Pressure Distribution

The objective of low pressure distribution systems is to provide uniform distribution of effluent to the soil environment in a very controlled manner to increase the systems efficiency and overall long-term performance.

The design requirements detailed in the table below are considered time tested best practices for pressure distribution network design. However, due to the number of dependant interchangeable variables in a pressure system design; system designer discretion is allowed.

For example, force main and manifold sizing are a system designer choice based on pump characteristics, distance between pump and distribution laterals, minimum velocity, flow rate, and pipe volume. Orifice size, spacing, and orientation on the lateral pipe are also a system designer choice based on system hydraulics and system designer preference.

Item	**Standard**
Lateral Size	¾-inch to 3-inches
Force Mains	System designer choice
Manifold	System designer choice
Clean-out at Terminal End	Long sweep elbow with threaded caps with accessible clean out box
Orifice Shields	Required in stone aggregate installations
Orifice Position	System designer choice.
Lateral Orientation	Level to slight fall toward tank for drainback. Hole at tank to allow for draining of distribution line.
Orifice Diameter	1/8“min to¼” maximum for septic tank effluent. Smaller orifices may be considered for highly treated effluent
Residual Design Head	Minimums: 2 ft (1/4” orifice) 3 ft (3/16” orifice) 5 ft (1/8” orifice)

14.9 Mechanical Distribution Valves

The use of distribution valves allow a system designer to break a large dispersal field into smaller zones, thus minimizing pipe size and pump size resulting energy conservation. Furthermore, the valves can help optimize treatment by allowing a zone to receive a small volume dose while the remaining zones can “rest” between dose cycles. Valves can also be utilized to provide equal distribution of effluent to trenches located on slopes.

Item	Standard
Elevation	Highest point of dispersal field for proper sequencing of valve
Valve Accessibility and Freeze Protection	Required - Must be accessible and placed in an insulated housing to prevent freezing
Force Main to the Valve	Should remain full for valve to sequence properly
Pump Selection	Must consider frictional losses through valve

14.10 Drop Boxes

Drop Boxes are used to distribute effluent through sequential distribution to trenches in a soil dispersal system. They can be used on sloping or level sites and allow for flexibility in the number and length of trenches. There is no maximum slope of site in which they can be used and they allow for quick inspection at the box of flows to the trenches. The concept consists of gravity effluent diversion into one trench. When the effluent fills the trench and reaches the pipe outlet it then flows into a second trench until it reaches capacity, then to a third or more as needed.

Item	Standard
Construction Material	Durable and resistant to corrosion
Box Footing	Compacted sand, or gravel to prevent differential settling
Water-tight Pipe Connections	Required
Internal Flow Control Mechanism	Required
Accessible Cover	Required
Drop Box Connecting Piping	Non-perforated pipe

14.11 Drip Irrigation

Drip Irrigation systems allow for a very controlled application of effluent to the shallow soil environment. This reduces the oxygen displaced by effluent applied to the soil maintaining a healthier aerobic soil ecosystem in and around the system.

Item	Standard
Types of Drip Tubing	Non-pressure compensating and pressure compensating

14.12 Stone-less Systems

Stone-less systems include chamber systems and man-made non-aggregate material (e.g. tire chips, glass, etc.). Systems of this category can offer a good design solution for a variety of applications. Specific consideration may be given to stone-less systems when clean stone aggregate is not available; at sites with limited equipment access; or where sensitive soils are present that will be compacted or smeared by the use of heavy equipment to carry in the materials.

Item	**Standard**
Sizing	Bottom area same as equivalent stone aggregate system
Installations	Installed per manufacture's specifications